

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number

4-03

Other  Amendment Number:

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 03/31/2016  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Indicators of Final Ecosystem

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
Sections 3 and 4

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 03/31/2016

Comments:  
WA 4-03 Full Title: Indicators of Final Ecosystem Goods and Services  
This WA continues WA 3-03. See attached SOW. 150 hours are included for preparation of the work plan and to begin working on the WA.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
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4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee: LOE:

Cumulative Approved: Cost/Fee: LOE:

Work Assignment Manager Name Paul Ringold

Branch/Mail Code:  
Phone Number 541-754-4565  
FAX Number:

\_\_\_\_\_  
(Signature) (Date)

Project Officer Name Jolynn Collins

Branch/Mail Code:  
Phone Number: 919-541-5671  
FAX Number:

\_\_\_\_\_  
(Signature) (Date)

Other Agency Official Name

Branch/Mail Code:  
Phone Number:  
FAX Number:

\_\_\_\_\_  
(Signature) (Date)

Contracting Official Name Rodney-Daryl Jones

Branch/Mail Code:  
Phone Number: 919-541-3112  
FAX Number:

\_\_\_\_\_  
(Signature) (Date)

## Statement of Work

**I. Title: Metrics and Indicators of Final Ecosystem Goods and Services**  
**Contractor Name: RTI**  
**Contract #: EP-W-11-029**  
**WA #: TBD (Continuation of WA 3-03)**

**II. Work Assignment Manager (WAM):**

WAM Name: Paul L. Ringold  
U.S. Environmental Protection Agency  
Office: Office of Research and Development, NHEERL  
Western Ecology Division  
Corvallis, OR 97333  
Phone: (541) 754-4565

Alt. WAM Name: None

**III. Background:**

Efforts under this Work Assignment provide technical support for the identification of indicators of Final Ecosystem Goods and Services (FEGS). The contractor shall conduct work in three areas:

1. Key Questions: The purpose of the effort is to describe a) the importance and use of FEGS, and b) research necessary to identify useful metrics and indicators of these biophysical features.
2. Atmospheric Deposition Case Studies: The purpose of this research is to extend, illustrate and evaluate FEGS concepts developed for three aquatic ecosystems to published analyses of benefits arising from changes in atmospheric deposition.
3. Analysis of the gaps between information we would like to have to represent FEGS and information we do have to represent FEGS at regional scales.

Material on FEGS concepts is available in (Boyd and Banzhaf 2007, Boyd and Krupnick 2009, Ringold et al. 2009, Johnston and Russell 2011, Ringold et al. 2011, Ringold et al. 2012, Ringold et al. 2013).

**IV. Description and Tasks:**

**Task #1: Work Plan**

The Contractor shall develop a new work plan. The Contractor shall hold conference calls with the WAM on at least a biweekly basis after approval of the work plan to plan and review progress of this WA.

## **Task #2: Key Questions on FEGS Indicators**

The Contactor shall provide technical support to respond to external reviewer comments on the February 2015 draft of the document. This draft is 77 single spaced pages long. The current structure of this paper is:

1. Preface
2. Linking Indicators: Guiding Principles and Theory
  - a. Ecological Systems and Social Comprehension
  - b. The Accuracy of Social Evaluation
  - c. Are These Outcomes the Same as “Final Ecosystem Goods and Services”?
  - d. The Importance of Beneficiary-Specific Indicators
  - e. Summary
3. Deploying Linking Indicators
  - a. Linking indicators as Status Measures for Public Communication
  - b. Linking indicators as Units of Environmental Account
  - c. Monetary Valuation of FEGS in Cost-Benefit Analysis
4. Identification and Analysis of Key Topics
  - i. Linking Indicators conceptual foundation
  - ii. Characteristics of Ecological Indicator Specification
  - iii. Gaps in current practice
  - b. Key Topics
  - c. Text Box
5. Linking Indicators Literature Review
  - a. Introduction
    - i. The Role of Linking Indicators within Revealed and Stated Preference Valuation
  - b. Key Questions
  - c. Literature Review to Answer Key Questions
    - i. Performance Metrics
    - ii. Proximal Indicators Better
    - iii. Beneficiaries
    - iv. In-Category Aggregation
    - v. Cross Category Aggregation
    - vi. Temporal and Spatial Dimensions
    - vii. Existence and Nonuse Value Indicators
    - viii. Units of account
    - ix. Summary
6. Conclusions and Recommendations

The revised draft shall be Deliverable 2. Deliverable 2 shall be made available as a working paper on a publicly available website. Preparation of the working paper may require editing for formatting and accessibility. The working paper may be posted as an EPA document, as an RTI document, or as a document of any organization with which RTI may choose to contract. The decision with regard to posting the working paper shall be made by the WAM and by the organization publishing the final report.

The WAM will circulate this working paper to colleagues and scientists within EPA and elsewhere to secure an additional round of comments from both technical and programmatic perspectives. The WAM will provide these comments to the contractor and the contractor shall provide technical support to respond to this round of comments. The goal of this revision shall be to prepare one or more manuscripts suitable for submission to a journal. These manuscripts shall be provided as Deliverable 3.

The contractor shall also provide technical support to respond to review comments from the journal. This technical support shall be constitute Deliverable 4.

**Task #3: Atmospheric Deposition Case Studies**

The Contractor shall provide written monthly status reports on the progress of a journal manuscript on this topic. Each montly report shall include the current draft of the manuscript, a description of changes in the manuscript over the previous month and plans for improvements. These monthly status reports constitute Deliverable 5A through F. A draft (Deliverable 6) will be submitted for clearance through EPA. A revision in response to those comments will be submitted to a peer-reviewed journal (Deliverable 7) and technical support shall be provided in response to comments from the journal editor through to publication. This technical support shall constitute Deliverable 8.

**Task #4: Gap Analysis**

The Contractor shall provide technical comments on a manuscript which identified gaps in the capacity to report on indicators and metrics of FECS for stream ecosystems on a regional basis. These comments constitute Deliverable 9.

**V. QA Requirements:**

**VI. Deliverables:**

The Contractor shall adhere to the following schedule

Task	Deliverable	Delivery Schedule
1	Work Plan	20 days after effective date of WA
2	Working Paper Posted on Publicly Accessible Website	Within 8 weeks after the activation of the WA

Task	Deliverable	Delivery Schedule
3	One or more manuscripts submitted to a journal.	The first shall be submitted by September 30, 2015
4	Technical support for revisions to manuscripts submitted to journals.	Two weeks after comments provided by WAM.
5A to 5F	Monthly Status Reports on the manuscript	The first Wednesday of each month after the work is initiated by written request from the WAM
6	Draft for EPA clearance	Three months after work is initiated by written request from the WAM.
7	Draft for journal submission	One month after comments are provided from the EPA clearance review as provided by the WAM.
8	Technical support for revisions in response to review comments from the journal	Three weeks after comments are provided by the WAM.
9	Technical Comments on a manuscript provided by the WAM.	Two weeks after requested by the WAM.

## VII. Reporting Requirements:

The Contractor shall provide monthly progress reports in accordance with the terms of the contract. The Contractor shall submit work products in electronic as well as hard copy form. In addition, the Contractor shall deliver to the WAM each draft and final report in electronic format that is readable by windows-based word-processing (Microsoft Word 2003), graphics (Microsoft PowerPoint 2003), spreadsheet (Excel 2003), and database (Access 2003) programs. The Contractor shall also provide electronic copies of reports in PDF format.

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-03

Other  Amendment Number:  
000001

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 09/30/2016  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Metrics & Indicators of Fin

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
Sections 3 & 5

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 03/31/2016

Comments:  
Two actions: (1) change signature line for both Project Officer (Carolyn Blake) and Contracting Officer (Marsha Johnson); (2) Inform Contractor that hours/cost will be decreased to what actually used (decrease from 450 hrs to 306 hrs/Cost\_Fee decrease from \$66,963 to \$44,250.97).

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 09/30/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Paul Ringold

Branch/Mail Code:  
Phone Number: 541-754-4565  
FAX Number:

\_\_\_\_\_  
(Signature) (Date)

Project Officer Name Carolyn Blake

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

\_\_\_\_\_  
(Signature) (Date)

Other Agency Official Name Judy Ancharski

Branch/Mail Code:  
Phone Number: 919-541-5586  
FAX Number:

\_\_\_\_\_  
(Signature) (Date)

Contracting Official Name Andrew Flynn

Branch/Mail Code:  
Phone Number: 919-541-2674  
FAX Number: 919-541-0611

\_\_\_\_\_  
(Signature) (Date)

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number

4-04

Other  Amendment Number:

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 03/31/2016

Title of Work Assignment/SF Site Name

Base Option Period Number 4

Air Deposition to Freshwater S

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
Sections 4, 6, 8, 10 & 15

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance

From 04/01/2015 To 03/31/2016

Comments:  
WA 4-04 Full Title: Air Deposition to Freshwater Systems

This WA continues WA 3-04. See attached SOW. 150 hours are provided for preparation of the work plan and to begin working on the WA.

Superfund

Accounting and Appropriations Data

Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2)

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee: LOE:

Cumulative Approved: Cost/Fee: LOE:

Work Assignment Manager Name Randy Waite

Branch/Mail Code:

Phone Number 919-541-5447

FAX Number:

(Signature)

(Date)

Project Officer Name Jolynn Collins

Branch/Mail Code:

Phone Number: 919-541-5671

FAX Number:

(Signature)

(Date)

Other Agency Official Name

Branch/Mail Code:

Phone Number:

FAX Number:

(Signature)

(Date)

Contracting Official Name Rodney-Daryl Jones

Branch/Mail Code:

Phone Number: 919-541-3112

FAX Number:

(Signature)

(Date)

## Statement of Work

**I. Title:** Air Deposition to Freshwater Systems  
**Contractor Name:** Research Triangle Institute  
**Contract #:** EP-W-11-029  
**WA #:** 4-04

**II. Work Assignment Manager (WAM):**

WAM Name: Randy Waite  
U.S. Environmental Protection Agency  
OAQPS, Health and Environmental Impacts Division, C504-04  
RTP, NC 27711  
Phone: (919) 541-5447

Alt. WAM Name: Christine Davis  
U.S. Environmental Protection Agency  
OAQPS, Health and Environmental Impacts Division, C539-07  
RTP, NC 27711  
Phone: (919) 541-1565

**III. Background:**

EPA must review the National Ambient Air Quality Standards (NAAQS) every five years. EPA has begun the next review of the secondary NO<sub>x</sub>SO<sub>x</sub> NAAQS. Determining air deposition impacts on eutrophication of freshwater systems is problematic due to the abundance of sources that contribute to the nitrogen load and the variability of waterbody responses to specific loads. This is an issue that has been very difficult to address in the NO<sub>x</sub>SO<sub>x</sub> review, but is important because of the potential for widespread impacts. The project will conduct course scale modeling of nitrogen loads to waterbodies and examine where air deposition is sufficient to surpass tipping points that exceed nitrogen criteria for individual waterbodies.

**IV. Description and Tasks:** The Work Assignment Manager (WAM) is authorized to provide technical direction in accordance with the contract. The Contractor shall not duplicate any work previously performed. In accordance with the contract statement of work (SOW), the Contractor shall perform the following tasks:

**Task 1: Work plan and progress reports.**

The Contractor shall develop a new work plan. The Contractor shall provide monthly progress reports to the WAM after approval of the work plan to review progress of this work assignment (WA).

**Task 2: Model air deposition impacts to freshwater systems**

The Contractor shall utilize EPA published water quality criteria for nitrogen in a test region and utilize existing water quality data. In particular, the Contractor shall:

1. Gather and review existing nitrogen water quality criteria for various regions of the country and for various waterbody types. Import water quality criteria maps into GIS.
2. Submit a recommendation for review by the WAM of a particular region and waterbody type for this study.
3. Gather existing water quality data for the approved waterbodies and determine which waterbodies exceed the recommended water quality criteria based on nitrogen limitation.
4. Gather existing nitrogen load data for the waterbodies.
5. Conduct course scale modeling or GIS analyses of impacted waterbodies for point and nonpoint source loads.
6. Compare terrestrial loads to air deposition loads to understand the importance of air deposition versus other loads.

### **Task 3: Reports**

The Contractor shall submit a draft report to the WAM for review, detailing the findings of this study. The Contractor shall submit a final report for approval by the WAM.

### **V. QA Requirements:**

The Contractor shall include a quality assurance section in the final report discussing the data used with respect to precision, accuracy, representativeness, comparability, completeness, sensitivity, and appropriateness as it applies to this use and its source. The QA section will discuss how the Contractor ensured that the environmental data were of acceptable quality and that they were being used for the purpose for which they were collected.

### **VI. Deliverables:**

The Contractor shall adhere to the following schedule:

<b>Task</b>	<b>Deliverable</b>	<b>Delivery Schedule</b>
1	Work Plan	20 days after effective date of WA
2	Region and waterbody type recommendation	3 months after approval of work plan
3	Draft report	January 31, 2016
4	Final Report	March 15, 2016

### **VII. Reporting Requirements:**

The Contractor shall provide monthly progress reports in accordance with the terms of the contract. The Contractor shall submit work products in electronic as well as hard copy form. In addition, the Contractor shall deliver to the WAM each draft and final report in electronic

format that is readable by windows-based word-processing (Microsoft Word 2003), graphics (Microsoft PowerPoint 2003), spreadsheet (Excel 2003), and database (Access 2003) programs. The Contractor shall also provide electronic copies of reports in PDF format.

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number

4-04

Other  Amendment Number:  
000001

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 03/31/2016  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Air Deposition to Freshwater S

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 07/31/2015 To 03/31/2016

Comments:  
WA 4-04 Full Title: Air Deposition to Freshwater Systems  
See attached for added Tasks 4 & 5. A revised cost estimate is required. 100 hours are added for preparation of the revised cost estimate and to continue work on the work assignment.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee: LOE:

Cumulative Approved: Cost/Fee: LOE:

Work Assignment Manager Name Randy Waite

Branch/Mail Code:  
Phone Number 919-541-5447  
FAX Number:

\_\_\_\_\_  
(Signature) (Date)

Project Officer Name Jolynn Collins

Branch/Mail Code:  
Phone Number: 919-541-5671  
FAX Number:

\_\_\_\_\_  
(Signature) (Date)

Other Agency Official Name

Branch/Mail Code:  
Phone Number:  
FAX Number:

\_\_\_\_\_  
(Signature) (Date)

Contracting Official Name Antonio L. Leathers

Branch/Mail Code:  
Phone Number: 919-541-2312  
FAX Number:

\_\_\_\_\_  
(Signature) (Date)

Title: Air Deposition to Freshwater Systems

WA: 4-04

Task 4: The Contractor shall utilize results from the Task 2 Pilot Test to extend the GIS analyses nationally. The Contractor shall discuss the results of the pilot study with the WAM and receive approval from the WAM before selecting national analysis criteria. The Contractor shall conduct the national analyses and present the results in GIS mapping format as part of the final report.

Task 5: The Contractor shall develop a journal article for publication in a peer reviewed journal based on the work process (linking critical loads of nitrogen deposition to ecosystem services) developed for the Air Quality Ecosystem Services Workshop (Feb 24-26, 2015) sponsored by the National Park Service and attended by the Contractor. The Contractor shall arrange a teleconference with the WAM and key leaders of the workshop to discuss format and content of the article. The Contractor shall draft the article for review by the WAM and submit a final copy to an agreed upon journal.

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number

4-04

Other  Amendment Number:  
000002

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 03/31/2016

Title of Work Assignment/SF Site Name

Base Option Period Number 4

Air Deposition to Freshwater S

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
4, 6, 8, 10 & 15

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance

From 07/31/2015 To 03/31/2016

Comments:

DUE TO BUDGETARY CONSTRAINTS, CONTRACTOR SHALL NOT EXCEED COST/FEE OF \$43,912 ON THIS WORK ASSIGNMENT UNTIL AUTHORIZED BY THE CONTRACTING OFFICER.

Superfund

Accounting and Appropriations Data

Non-Superfund

Note: To report additional accounting and appropriations data use EPA Form 1900-69A.

SFO (Max 2)

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee: LOE:

Cumulative Approved: Cost/Fee: LOE:

Work Assignment Manager Name Randy Waite

Branch/Mail Code:

Phone Number 919-541-5447

FAX Number:

(Signature)

(Date)

Project Officer Name Carolyn Blake

Branch/Mail Code:

Phone Number: 919-541-5256

FAX Number:

(Signature)

(Date)

Other Agency Official Name

Branch/Mail Code:

Phone Number:

FAX Number:

(Signature)

(Date)

Contracting Official Name Antonio L. Leathers

Branch/Mail Code:

Phone Number: 919-541-2312

FAX Number:

(Signature)

(Date)

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-04

Other  Amendment Number:  
000003

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 09/30/2016  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Metrics & Indicators of Fin...

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
Sections 3 and 4

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 07/31/2015 To 09/30/2016

Comments:  
THIS AMENDMENT TO EXTEND CURRENT OPTION PERIOD (4), POP, FOR 6 MONTHS (ENDING 9/30/2016). SOW REVISED TO ADD TASKS (SEE ATTACHMENT). CONTRACTOR SHALL PROVIDE REVISED WORKPLAN/COST ESTIMATE AS A RESULT OF THESE CHANGES/EXTENSION. BUDGETARY CAP IS LIFTED. NO PREVIOUSLY PERFORMED WORK SHALL BE DUPLICATED.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 09/30/2016 Cost/Fee: LOE:

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Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Randy Waite  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5447  
FAX Number:

Project Officer Name Carolyn Blake  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Marsha B. Johnson  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-0952  
FAX Number:

## **Title: Air Deposition to Freshwater Systems**

### **WA: 4-04**

**Task 6:** The Contractor shall utilize results from the Task 4 analysis and select an impaired lake dominated by air deposition to be approved by the Work Assignment Manager (WAM). The Contractor shall model nitrogen loading to the lake utilizing two deposition scenarios (supplied by the WAM) to the watershed and lake surface. The Contractor shall model changes to water quality and biological indicators that can best be linked to final ecosystem goods and services. The Contractor shall recommend for approval by the WAM, the models to be used in the analysis. The Contractor shall produce a report describing the analysis and results. The Contractor shall train 1-2 EPA staff members on the specific models used in the analysis, not to exceed 4 hours.

**Task 7:** The Contractor shall develop a conceptual risk assessment approach for analyzing the impacts of nitrogen deposition to estuarine areas on a broad scale. The approach shall include how to analyze impacts to nitrogen sensitive estuaries from different air deposition scenarios. The Contractor shall draft 2-3 conceptual approaches for discussion with the WAM. The WAM will select one approach to be fully fleshed out in a final short report by the Contractor.

**Task 8:** The Contractor shall develop a conceptual risk assessment approach for analyzing the impacts of nitrogen deposition to sensitive freshwater wetland areas on a broad scale. The approach shall include how to analyze impacts to nitrogen sensitive wetlands from different air deposition scenarios. The Contractor shall draft 2-3 conceptual approaches for discussion with the WAM. The WAM will select one approach to be fully fleshed out in a final short report by the Contractor.

**Task 9:** The Contractor shall develop a conceptual risk assessment approach for analyzing the impacts of sulfur deposition to freshwater mercury sensitive areas on a broad scale, i.e., the impact on sulfur deposition to increased mercury methylation in the waterbodies. The approach shall include how to analyze impacts of sulfur to mercury methylation in fresh waterbodies from different air deposition scenarios. The Contractor shall draft 2-3 conceptual approaches for discussion with the WAM. The WAM will select one approach to be fully fleshed out in a final short report by the Contractor.

**Deliverables:** All task reports are due to the WAM by the end of the Project Period.

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-04

Other  Amendment Number:  
000004

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 09/30/2016  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Air Deposition to Freshwater .

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
Sections 3 and 4

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 07/31/2015 To 09/30/2016

Comments:  
THIS AMENDMENT TO LIFT BUDGETARY CAP AND TO CHANGE CO FROM MARSHA JOHNSON TO ANDREW FLYNN.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

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Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Randy Waite  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5447  
FAX Number:

Project Officer Name Carolyn Blake  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Andrew Flynn  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-2674  
FAX Number: 919-541-0611

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-04

Other  Amendment Number:  
000005

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 05/31/2017  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Air Deposition to Freshwater

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
Sections 3 and 4

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 07/31/2015 To 05/31/2017

Comments:  
THIS AMENDMENT IS TO EXTEND THE CURRENT OPTION PERIOD FOR 8 MONTHS (ENDING 5/31/2017). CONTRACTOR SHALL PROCEED WITH WORK ASSIGNMENT, REVISING COST ESTIMATE IF NEEDED. NO PREVIOUSLY PERFORMED WORK SHALL BE DUPLICATED.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations data use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 05/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Randy Waite

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5447  
FAX Number:

Project Officer Name Carolyn Blake

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Andrew Flynn

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-2674  
FAX Number: 919-541-0611

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-04

Other  Amendment Number:  
000006

Contract Number  
EP-W-11-029

Contract Period 06/01/2017 To 11/30/2019  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Air Deposition to Freshwater

Contractor  
Research Triangle Institute

Specify Section and paragraph of Contract SOW  
Sections 3 and 4

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 07/31/2015 To 05/31/2017

Comments:  
SOW amended (see attachment) to add tasks to the SOW. Contractor shall prepare a revised work plan/cost estimate in response to these changes. 100 hours added to WA for preparation of revised Work Plan/continue work. No previously performed work shall be duplicated.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 06/01/2017 To 11/30/2019 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee: LOE:

Cumulative Approved: Cost/Fee: LOE:

Work Assignment Manager Name Randy Waite

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5447  
FAX Number:

Project Officer Name Carolyn Blake

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Christopher Davis

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-4609  
FAX Number: 919-685-3415

### **Task 10: Literature Search for Ecosystem Services**

The Contractor shall conduct a literature search for ecosystem services, utilizing the final ecosystem goods and services (FEGS) identified in the National Park Service report and related journal articles on the Air Quality Ecosystem Services Workshop. The Contractor shall also search for economics research (market and non-market) published since the last NOx/SOx review that relates to those services/endpoints. This search shall also include any available government or industry sources of data useful for evaluating the FEGS and their connection to the national ecosystem services classification system (NESCO). The Contractor shall identify possible methods for using identified papers as a basis for incremental analysis of changes in depositional effects of nitrogen to incremental changes in ecosystem services.

The Contractor shall compile a list of the articles and materials found and meet with the WAM to discuss which ones to further pursue and summarize. The Contractor shall draft a summary report for the WAM's review and approval. The Contractor shall then develop a final report for submittal to the WAM. The final report shall be submitted no later than April 28, 2017.

### **Task 11: FEGS-CS and NESCO Connections**

To date, there has not been a systematic approach that could be broadly applied to identify components of nature that are important to humans and which can be measured, quantified, and used in environmental policy analyses. The Final Ecosystem Goods and Services Classification System (FEGS-CS), along with the National Ecosystem Services Classification System (NESCO), are classification systems that provide an architecture for the identification and measurement of stocks (FEGS-CS) and flows (NESCO) of final ecosystem goods and services. When applied together, these systems offer the ability to assist in linking stressors to policy endpoints, both human and natural, which affect the environment in different ways. These approaches should be generally repeatable by practitioners possessing basic knowledge of ecology and economics.

The Contractor shall attend a kickoff meeting with the WAM within two weeks of the receipt of this task, prior to development of the work plan. The WAM will include key EPA-ORD identified experts to also attend the meeting. The experts will serve to advise the WAM on the technical issues related to this topic. The Contractor shall identify key questions about the structure of the FEGS-CS and its application to this task prior to the meeting. The Contractor shall then attend a conference call with the WAM and named technical experts within 2 weeks after submitting the work plan.

The Contractor shall utilize the output of the NPS AQES workshops and WAM supplied requirements of the NOx/SOx Secondary NAAQS review to connect Final Ecosystem Goods and Services of importance to secondary air standards and also to National Economic Accounts. The Contractor shall identify a comprehensive set of FEGS potentially affected by deposition of

nitrogen and/or sulfur and map those FEGS to the NESCS classification system and identify the available economic data and methods useful for quantifying the incremental changes in services and values due to a policy change. The contractor shall identify any refinements to the FEGS-CS that are needed to or which may be useful to enhance the utility of the system as it could be used in benefits analyses or for other related purposes.

The Contractor shall produce FEGS/NESCS diagrams, tables, potentially maps of the results of the application. The Contractor shall draft for peer-review, a journal article demonstrating linkages among final ecosystem goods and services (FEGS-CS), NESCS, and National Economic Accounts which also identifies the environmental and economic data and system requirements available to make these connections functional and practical for an actual or realistic policy context.

All work shall be completed and a draft of the journal article submitted to EPA by May 15, 2017.

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-04

Other  Amendment Number:  
000007

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 05/31/2017  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Air Deposition to Freshwater

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
Sections 3 and 4

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 07/31/2015 To 05/31/2017

Comments:  
This amendment to replace the Primary WAM from Randy Waite to Vicki Sandiford. Vicki's contact info: email: sandiford.vicki@epa.gov, Phone No.: 919-541-2629.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 05/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Vicki Sandiford  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-2629  
FAX Number:

Project Officer Name Carolyn Blake  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Christopher Davis  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-4609  
FAX Number: 919-685-3415

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-04

Other  Amendment Number:  
000008

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 11/30/2017  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Air Deposition to Freshwater

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
Sections 3 and 4

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 07/31/2015 To 11/30/2017

Comments:  
THIS AMENDMENT IS TO EXTEND THE CURRENT OPTION PERIOD (4) FOR 6 MONTHS (ENDING 11/30/2017). CONTRACTOR SHALL PROCEED WITH WORK ASSIGNMENT, REVISING COST ESTIMATE IF NEEDED. NO PREVIOUSLY PERFORMED WORK SHALL BE DUPLICATED.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 11/30/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Vicki Sandiford  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-2629  
FAX Number:

Project Officer Name Carolyn Blake  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Christopher Davis  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-4609  
FAX Number: 919-685-3415

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-04

Other  Amendment Number:  
000009

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 11/30/2017  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Air Deposition to Freshwater

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
Sections 3 and 4

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 07/31/2015 To 11/30/2017

Comments:  
See attached amendment to the Statement of Work (SOW). The Contractor shall prepare a revised work plan/cost estimate in response to the amended SOW. No previously performed work shall be duplicated in this effort.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 11/30/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Vicki Sandiford  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-2629  
FAX Number:

Project Officer Name Carolyn Blake  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Christopher Davis  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-4609  
FAX Number: 919-685-3415

## Statement of Work

**I. Title:** Air Deposition to Freshwater Systems  
**Contractor Name:** Research Triangle Institute  
**Contract #:** EP-W-11-029  
**WA #:** 4-04 (Amendment – see new task below)

**II. Work Assignment Manager (WAM):**

WAM Name: Vicki Sandiford  
U.S. Environmental Protection Agency  
OAQPS, Health and Environmental Impacts Division, C504-04  
RTP, NC 27711  
Phone: (919) 541-2629

Alt. WAM Name: Christine Davis  
U.S. Environmental Protection Agency  
OAQPS, Health and Environmental Impacts Division, C539-07  
RTP, NC 27711  
Phone: (919) 541-1565

**III. Background:**

EPA must review the National Ambient Air Quality Standards (NAAQS) every five years. EPA has begun the next review of the secondary NO<sub>x</sub>SO<sub>x</sub> NAAQS. Determining air deposition impacts on eutrophication of freshwater systems is problematic due to the abundance of sources that contribute to the nitrogen load and the variability of waterbody responses to specific loads. This is an issue that has been very difficult to address in the NO<sub>x</sub>SO<sub>x</sub> review, but is important because of the potential for widespread impacts. The project will conduct course scale modeling of nitrogen loads to waterbodies and examine where air deposition is sufficient to surpass tipping points that exceed nitrogen criteria for individual waterbodies.

**IV. Description and Tasks:** The Work Assignment Manager (WAM) is authorized to provide technical direction in accordance with the contract. The Contractor shall not duplicate any work previously performed. In accordance with the contract statement of work (SOW), the Contractor shall perform the following tasks:

**Task 1: Work plan and progress reports.**

The Contractor shall develop a new work plan. The Contractor shall provide monthly progress reports to the WAM after approval of the work plan to review progress of this work assignment (WA).

## **Task 12: Conference Travel**

The Contractor shall attend the 13<sup>th</sup> International Conference on Mercury as a Global Pollutant being held in Rhode Island the week of July 17 – 21, 2017. The WAM, in reviewing the conference agenda has determined that many of the session topics and posters being presented, as well as opportunities for related discussions, have the potential to usefully inform the work being conducted by the Contractor under Task 9. Due to the recent 6-month extension of the contract period of performance past the previous 05/31/17 performance end date, the WAM has determined that it is now prudent and feasible to delay completion of the final report deliverable until after the ICMGP. This allows the write-up of Task 9 results in the final report to include an understanding on how they compare with the latest research on this topic and fit in to this broader context.

### **V. QA Requirements:**

The Contractor shall include a quality assurance section in the final report discussing the data used with respect to precision, accuracy, representativeness, comparability, completeness, sensitivity, and appropriateness as it applies to this use and its source. The QA section will discuss how the Contractor ensured that the environmental data were of acceptable quality and that they were being used for the purpose for which they were collected.

### **VI. Deliverables:**

- Draft report of Task 9 results Mid-June
- Final Task 9 results 2 weeks after ICMGP

### **VII. Reporting Requirements:**

The Contractor shall provide monthly progress reports in accordance with the terms of the contract. The Contractor shall submit work products in electronic as well as hard copy form. In addition, the Contractor shall deliver to the WAM each draft and final report in electronic format that is readable by windows-based word-processing (Microsoft Word 2003), graphics (Microsoft PowerPoint 2003), spreadsheet (Excel 2003), and database (Access 2003) programs. The Contractor shall also provide electronic copies of reports in PDF format.

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-04

Other  Amendment Number:  
000010

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 11/30/2017  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Air Deposition to Freshwater

Contractor  
Research Triangle Institute

Specify Section and paragraph of Contract SOW  
Sections 3 and 4

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 07/31/2015 To 11/30/2017

Comments:  
The Statement of Work (SOW) is amended for WA 4-04 (see attachment) to add task to the SOW. The Contractor shall prepare a revised work plan/cost estimate in response to these changes. No previously performed work shall be duplicated.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 11/30/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee: LOE:

Cumulative Approved: Cost/Fee: LOE:

Work Assignment Manager Name Vicki Sandiford  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-2629  
FAX Number:

Project Officer Name Carolyn Blake  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Christopher Davis  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-4609  
FAX Number: 919-685-3415

**Statement of Work  
Amendment 10**

**I. Title:** Air Deposition to Freshwater Systems  
**Contractor Name:** Research Triangle Institute  
**Contract #:** EP-W-11-029  
**WA #:** 4-04

**II. Work Assignment Manager (WAM):**

WAM Name: Vicki Sandiford  
U.S. Environmental Protection Agency  
OAQPS, Health and Environmental Impacts Division, C504-04  
RTP, NC 27711  
Phone: (919) 541-2629

Alt. WAM Name: Christine Davis  
U.S. Environmental Protection Agency  
OAQPS, Health and Environmental Impacts Division, C539-07  
RTP, NC 27711  
Phone: (919) 541-1565

**III. Background:**

EPA must review the National Ambient Air Quality Standards (NAAQS) every five years. EPA has begun the next review of the secondary NO<sub>x</sub>SO<sub>x</sub> NAAQS. Determining air deposition impacts on eutrophication of freshwater systems is problematic due to the abundance of sources that contribute to the nitrogen load and the variability of waterbody responses to specific loads. This is an issue that has been very difficult to address in the NO<sub>x</sub>SO<sub>x</sub> review, but is important because of the potential for widespread impacts. The project will conduct course scale modeling of nitrogen loads to waterbodies and examine where air deposition is sufficient to surpass tipping points that exceed nitrogen criteria for individual waterbodies.

**IV. Description and Tasks:** The Work Assignment Manager (WAM) is authorized to provide technical direction in accordance with the contract. The Contractor shall not duplicate any work previously performed. In accordance with the contract statement of work (SOW), the Contractor shall perform the following tasks:

**Task 1: Work plan and progress reports.**

The Contractor shall develop a new work plan. The Contractor shall provide monthly progress reports to the WAM after approval of the work plan to review progress of this work assignment (WA).

### **Task 13: Methodological Approach Recommendations for Quantification of Ecosystem Services**

Due to the recent 6-month extension of the contract period of performance past the original 05/31/17 performance end date, the WAM has determined that it is now both feasible and useful to build on the current work described in Tasks 10 and 11, i.e. an ecosystem services literature search and recommendations for development of a FECS-NESCS joint classification system using the NOx/SOx review as a model, respectively, to include development of a detailed set of recommendations of methodological approaches that may be appropriate for quantitative analyses of ecosystem services changes based on the results of the previous Task 10 literature search. These recommendations and approaches would be described in a detailed report.

#### **V. QA Requirements:**

The Contractor shall include a quality assurance section in the final report discussing the data used with respect to precision, accuracy, representativeness, comparability, completeness, sensitivity, and appropriateness as it applies to this use and its source. The QA section will discuss how the Contractor ensured that the environmental data were of acceptable quality and that they were being used for the purpose for which they were collected.

#### **VI. Deliverables:**

- Preliminary recommendations memo August 15
- Final Task 13 Results/Report September 30

#### **VII. Reporting Requirements:**

The Contractor shall provide monthly progress reports in accordance with the terms of the contract. The Contractor shall submit work products in electronic as well as hard copy form. In addition, the Contractor shall deliver to the WAM each draft and final report in electronic format that is readable by windows-based word-processing (Microsoft Word 2003), graphics (Microsoft PowerPoint 2003), spreadsheet (Excel 2003), and database (Access 2003) programs. The Contractor shall also provide electronic copies of reports in PDF format.

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-04

Other  Amendment Number:  
000011

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 11/30/2017  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Air Deposition to Freshwater

Contractor  
Research Triangle Institute

Specify Section and paragraph of Contract SOW  
Sections 3 and 4

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 07/31/2015 To 11/30/2017

Comments:  
The purpose of this amendment is to correct the Work Plan approval of the cumulative cost/fee approved with Amendment 0010 to this Work Plan dated 11 Aug 2017. The total amount of the cumulative cost/fee approved is \$235,147.00. Total hours approved remains at 1,912. All other terms and conditions remain unchanged.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 11/30/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Vicki Sandiford

Branch/Mail Code:  
Phone Number: 919-541-2629  
FAX Number:

\_\_\_\_\_  
(Signature) (Date)

Project Officer Name Carolyn Blake

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

\_\_\_\_\_  
(Signature) (Date)

Other Agency Official Name

Branch/Mail Code:  
Phone Number:  
FAX Number:

\_\_\_\_\_  
(Signature) (Date)

Contracting Official Name Christopher Davis

Branch/Mail Code:  
Phone Number: 919-541-4609  
FAX Number: 919-685-3415

\_\_\_\_\_  
(Signature) (Date)

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-04

Other  Amendment Number:  
000012

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 05/31/2018  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Air Deposition to Freshwater

Contractor  
Research Triangle Institute

Specify Section and paragraph of Contract SOW  
Section 3 and 4

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 07/31/2015 To 05/31/2018

Comments:  
This amendment formalizes the direction by the CO on 11/29/17, via e-mail, to extend the current option period (4), period of performance, for 6 months (ending 05/31/2018). Contractor shall proceed with WA, revising cost estimate if needed. No previously performed work shall be duplicated.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations data use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 05/31/2018 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Vicki Sandiford  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-2629  
FAX Number:

Project Officer Name Carolyn Blake  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Christian Ford-Cannon  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-2147  
FAX Number:

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-04

Other  Amendment Number:  
000013

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 05/31/2018  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Air Deposition to Freshwater

Contractor  
Research Triangle Institute

Specify Section and paragraph of Contract SOW  
Sections 3 and 4

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 07/31/2015 To 05/31/2018

Comments:  
THIS AMENDMENT TO CHANGE TASK 11 OF SOW. REDLINE STRIKEOUT IS ATTACHED WITH CHANGES. CONTRACTOR SHALL INCORPORATE CHANGES FOR TASK 11 AND, IF NECESSARY, PROVIDE REVISED COST ESTIMATE.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 05/31/2018 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee: LOE:

Cumulative Approved: Cost/Fee: LOE:

Work Assignment Manager Name Vicki Sandiford  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-2629  
FAX Number:

Project Officer Name Carolyn Blake  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Christian Ford-Cannon  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-2147  
FAX Number:

**RTI EP-W-11-029 – Work Assignment 4-04**

**Amendment to Task 11: FECS and NESCS Connections**

To date, there has not been a systematic approach that could be broadly applied to identify components of nature that are important to humans and which can be measured, quantified, and used in environmental policy analyses. The Final Ecosystem Goods and Services Classification System (FECS), along with the National Ecosystem Services Classification System (NESCS), are classification systems that provide an architecture for the identification and measurement of stocks (FECS) and flows (NESCS) of final ecosystem goods and services. When applied together, these systems offer the ability to assist in linking stressors to policy endpoints, both human and natural, which affect the environment in different ways. These approaches should be generally repeatable by practitioners possessing basic knowledge of ecology and economics.

The Contractor shall attend a kickoff meeting with the WAM within two weeks of the receipt of this task, prior to development of the work plan. The WAM will include key EPA-ORD identified experts to also attend the meeting. The experts will serve to advise the WAM on the technical issues related to this topic. The Contractor shall identify key questions about the structure of the FECS and its application to this task prior to the meeting. The Contractor shall then attend a conference call with the WAM and named technical experts within 2 weeks after submitting the work plan.

The Contractor shall utilize the output of the NPS AQES workshops and WAM supplied requirements of the NOx/SOx Secondary NAAQS review to connect Final Ecosystem Goods and Services of importance to secondary air standards and also to National Economic Accounts. The Contractor shall identify a comprehensive set of FECS potentially affected by deposition of nitrogen and/or sulfur and map those FECS to the NESCS classification system and identify the available economic data and methods useful for quantifying the incremental changes in services and values due to a policy change. The contractor shall identify any refinements to the FECS that are needed to or which may be useful to enhance the utility of the system as it could be used in benefits analyses or for other related purposes.

The Contractor shall produce FECS CS diagrams, tables, table of contents- potentially maps of the results of the application. The Contractor shall draft

demonstrat linkages among final ecosystem goods and services (FECS), NESCS, and National Economic Accounts

also  
identif the environmental and economic data and system requirements available to make these connections functional and practical for an actual or realistic policy context

A draft of the  
submitted to EPA by Feb 05, 2 18 .

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-04

Other  Amendment Number:  
000014

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 05/31/2018  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Air Deposition to Freshwater

Contractor  
Research Triangle Institute

Specify Section and paragraph of Contract SOW  
Sections 3 and 4

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 07/31/2015 To 05/31/2018

Comments:  
This amendment is issued to have contractor stop work on this work assignment.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 05/31/2018 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Vicki Sandiford

Branch/Mail Code:  
Phone Number: 919-541-2629  
FAX Number:

(Signature) (Date)

Project Officer Name Carolyn Blake

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

(Signature) (Date)

Other Agency Official Name

Branch/Mail Code:  
Phone Number:  
FAX Number:

(Signature) (Date)

Contracting Official Name Christian Ford-Cannon

Branch/Mail Code:  
Phone Number: 919-541-2147  
FAX Number:

(Signature) (Date)

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number

4-05

Other  Amendment Number:

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 03/31/2016  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Enhancement of EMPAX\_S for NAA

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
Sections 1, 3, 4, 6, 7, 8, 11, 15, 16, 17

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 03/31/2016

Comments:  
WA 4-05 Full Title: Enhancement of EMPAX\_S for NAAQS Analyses  
This WA continues WA 3-05. See attached SOW. 100 hours are provided for preparation of the work plan and to begin working on the WA.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee: LOE:

Cumulative Approved: Cost/Fee: LOE:

Work Assignment Manager Name Tom Walton

Branch/Mail Code:  
Phone Number 919-541-5311  
FAX Number:

(Signature) (Date)

Project Officer Name Jolynn Collins

Branch/Mail Code:  
Phone Number: 919-541-5671  
FAX Number:

(Signature) (Date)

Other Agency Official Name

Branch/Mail Code:  
Phone Number:  
FAX Number:

(Signature) (Date)

Contracting Official Name Rodney-Daryl Jones

Branch/Mail Code:  
Phone Number: 919-541-3112  
FAX Number:

(Signature) (Date)

**I. TITLE: Enhancement of EMPAX\_S for NAAQS Analyses**

**II. WORK ASSIGNMENT MANAGER (WAM):**

Tom Walton  
U. S. Environmental Protection Agency  
Office of Air Quality Planning and Standards (OAQPS)  
Air Economics Group (AEG) (MD-C439-02)  
Research Triangle Park, NC 27711  
(919) 541-5311 (office) (919) 541-0839 (fax)  
[walton.tom@epa.gov](mailto:walton.tom@epa.gov)

Alternate WAM: Larry Sorrels  
(919)541-5041 (office) (919)541-5489 (fax)  
[sorrels.larry@epa.gov](mailto:sorrels.larry@epa.gov)

**IV. BACKGROUND:**

The Environmental Protection Agency (EPA) is currently engaged in revisions of National Ambient Air Quality Standards (NAAQS). EPA must be prepared to model the market and employment impacts of NAAQS. A static version of EMPAX has been partially developed by this contractor in earlier work assignments (most recently contract number EP-W-11-029, work assignment 5). The work performed in this work assignment will not duplicate any work performed in previous contracts or work assignments.

The purpose of this work assignment (WA) is to enhance the model to include a more complete benefit analyses and test the model for alternate ways to incorporate costs.

**V. STATEMENT OF WORK (SOW):**

The work assignment manager (WAM) is authorized to provide technical direction in accordance with the contract. In accordance with the contract SOW, the Contractor shall perform the following tasks:

**Task 1: Prepare Work Plan**

The Contractor is required to prepare a work plan for this WA in accordance with the contract. The Contractor shall submit this work plan to the WAM within 20 days of the effective date of the WA. The Contractor shall contact the WAM by phone within 7 days of the effective date of the WA to discuss progress on the work plan.

**Task 2: Enhance EMPAX-S**

The Contractor shall develop the capability for EMPAX to include benefits, linkages with other models, and alternative approaches to incorporating costs.

### **Deliverables Under Task 2**

- |    |                               |   |
|----|-------------------------------|---|
| 2a | Provide plan for model change | No later than 7 weeks after approval of the Work Plan                           |
| 2b | Revised EMPAX model           | Within 6 months after receipt of comments from the WAM on the plan model change |

### **Task 3: Model Testing**

The contractor shall develop a plan to investigate model performance for incorporating benefits, linking to other models, and incorporating cost.

The contractor shall carry out the plan after approval of the plan by the WAM

### **Deliverables Under Task 3**

- |    |   |   |
|----|---|---|
| 3a | Prepare a plan to investigate the issues described above. | No later than 2 weeks after receipt of technical direction from the WAM |
| 3b | Prepare Final Report on the results                       | No later than 2 months after receipt of comments from the WAM           |

### **VI. REPORTING REQUIREMENTS:**

With any analysis provided to EPA, the Contractor shall provide an assessment of the quality and appropriateness of any data used in the analysis.

All reports shall be in accordance with contract specifications. In addition, for draft deliverables, two hard copies shall be delivered to the WAM if requested for review and comments and the draft report shall be emailed to the WAM. For final report deliverables, the report shall be emailed to the WAM and three copies shall be delivered to the WAM with an accompanying master copy in both hardcopy and electronic format on a CD-ROM as necessary (a searchable PDF in Adobe Acrobat 7.0 or higher, if requested by WAM, and MS Word 2007 format or higher). Draft and final tabular data or programs shall be delivered in the appropriate electronic format (i.e., Excel spreadsheet, or other) as requested by the EPA WAM. All software files provided to the WAM during the course of this WA shall be free of all known computer viruses, spyware, and malware prior to delivery.

The Contractor shall also contact the WAM once per week by phone after receipt of the work assignment after to discuss progress on the tasks included therein. This requirement is in addition to required phone call stated in Task 1.

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-05

Other  Amendment Number:  
000001

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 03/31/2016  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Enhancement of EMPAX S for NAA

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
1, 3, 4, 6, 7, 8, 11, 15, 16, 17

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 03/31/2016

Comments:  
THIS WA AMENDED TO CHANGE WORK ASSIGNMENT MANAGER FROM TOM WALTON TO ALEX MACPHERSON. NO PREVIOUSLY PERFORMED WORK SHALL BE DUPLICATED.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations data use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee: LOE:

Cumulative Approved: Cost/Fee: LOE:

Work Assignment Manager Name Alex Macpherson

Branch/Mail Code:  
Phone Number 919-541-9770  
FAX Number:

(Signature) (Date)

Project Officer Name Carolyn Blake

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

(Signature) (Date)

Other Agency Official Name

Branch/Mail Code:  
Phone Number:  
FAX Number:

(Signature) (Date)

Contracting Official Name Rodney-Daryl Jones

Branch/Mail Code:  
Phone Number: 919-541-3112  
FAX Number:

(Signature) (Date)

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-05

Other  Amendment Number:  
000002

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 03/31/2016  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Enhancement of EMPAX S for NAA

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
1, 3, 4, 6, 7, 8, 11, 15, 16, 17

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 03/31/2016

Comments:  
This WA amended to change the Alternate COR from Larry Sorrels to Linda Chappell.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Alex Macpherson  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-9770  
FAX Number:

Project Officer Name Carolyn Blake  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Rodney-Daryl Jones  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-3112  
FAX Number:

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-05

Other  Amendment Number:  
000003

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 09/30/2016  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Enhancement of EMPAX for NAA

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
1, 3, 4, 6, 7, 8, 11, 15, 16, 17

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 03/31/2016

Comments:  
Two actions: (1) change signature lines in EAS for current PO and CO; (2) inform Contractor that hours/cost will be decreased to what actually used (decrease from 552 hours to 285 hrs/Cost\_Fee decrease from \$63,076 to \$60,974).

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 09/30/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Alex Macpherson  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-9770  
FAX Number:

Project Officer Name Carolyn Blake  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name Judy Ancharski  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5586  
FAX Number:

Contracting Official Name Andrew Flynn  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-2674  
FAX Number: 919-541-0611

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-04

Other  Amendment Number:  
000004

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 09/30/2016  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Air Deposition to Freshwater .

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
Sections 3 and 4

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 07/31/2015 To 09/30/2016

Comments:  
THIS AMENDMENT TO LIFT BUDGETARY CAP AND TO CHANGE CO FROM MARSHA JOHNSON TO ANDREW FLYNN.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 09/30/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Randy Waite  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5447  
FAX Number:

Project Officer Name Carolyn Blake  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Andrew Flynn  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-2674  
FAX Number: 919-541-0611

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-04

Other  Amendment Number:  
000005

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 05/31/2017  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Air Deposition to Freshwater

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
Sections 3 and 4

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 07/31/2015 To 05/31/2017

Comments:  
THIS AMENDMENT IS TO EXTEND THE CURRENT OPTION PERIOD FOR 8 MONTHS (ENDING 5/31/2017). CONTRACTOR SHALL PROCEED WITH WORK ASSIGNMENT, REVISING COST ESTIMATE IF NEEDED. NO PREVIOUSLY PERFORMED WORK SHALL BE DUPLICATED.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 05/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Randy Waite

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5447  
FAX Number:

Project Officer Name Carolyn Blake

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Andrew Flynn

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-2674  
FAX Number: 919-541-0611

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-04

Other  Amendment Number:  
000006

Contract Number  
EP-W-11-029

Contract Period 06/01/2017 To 09/30/2019  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Air Deposition to Freshwater

Contractor  
Research Triangle Institute

Specify Section and paragraph of Contract SOW  
Sections 3 and 4

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 07/31/2015 To 05/31/2017

Comments:  
SOW amended (see attachment) to add tasks to the SOW. Contractor shall prepare a revised work plan/cost estimate in response to these changes. 100 hours added to WA for preparation of revised Work Plan/continue work. No previously performed work shall be duplicated.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 06/01/2017 To 09/30/2019 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee: LOE:

Cumulative Approved: Cost/Fee: LOE:

Work Assignment Manager Name Randy Waite

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5447  
FAX Number:

Project Officer Name Carolyn Blake

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Christopher Davis

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-4609  
FAX Number: 919-685-3415

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-06

Other  Amendment Number:

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 09/30/2019  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Incorporating Multi-Pollutant

Contractor  
Research Triangle Institute

Specify Section and paragraph of Contract SOW  
Sections 10, 11, 12, 13

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 03/31/2016

Comments:  
WA 4-06 Full Title: Incorporating Multi-Pollutant Functionality into the BenMAP-CE Tool  
This WA continues WA 3-06. See attached SOW. 400 hours are provided for preparation of the work plan and

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 09/30/2019 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Neal Fann  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-0209  
FAX Number:

Project Officer Name Jolynn Collins  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5671  
FAX Number:

Other Agency Official Name  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Rodney-Daryl Jones  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-3112  
FAX Number:

**WORK ASSIGNMENT**  
ENVIRONMENTAL PROTECTION AGENCY  
RESEARCH TRIANGLE PARK, NC 27711

**I. TITLE**

**“Incorporating Multi-Pollutant Functionality into the BenMAP-CE Tool”**

**II. WORK ASSIGNMENT MANAGER (WAM):**

Neal Fann  
U.S. Environmental Protection Agency  
Office of Air Quality Planning and Standards  
Health and Environmental Impacts Division (C539-07)  
Research Triangle Park, NC 27711  
Phone: (919) 541-0209

Alternate WAM:

Phil Morefield  
U.S. Environmental Protection Agency  
Office of Research and Development  
National Center for Environmental Assessment (8601P)  
2733 Crystal Drive  
Arlington, VA 22202

**III. SUMMARY**

The purpose of this Work Assignment is to further improve the environmental Benefits Mapping and Analysis Program—Community Edition (BenMAP-CE) by initiating the multi-pollutant related tasks first outlined in Work Assignment 3-06. Under Work Assignment 3-06, the Contractor incorporated a module that employs data from the 2010 Global Burden of Disease tool to quantify the number of fine-particle related deaths in each country in the world; validate input data; and, report errors to the development team. Under this work assignment, the contractor will enable the tool to quantify the human health effects from two or more pollutants or stressors.

**IV. PROJECT BACKGROUND**

In 2003 the U.S. EPA contracted with a developer to create version 1.0 of the environmental Benefits Mapping and Analysis Program (BenMAP). That tool systematized a number of the steps of a health impact and benefits analysis that had previously been performed using a series of linked spreadsheets. Subsequent versions incorporated a number of new features, including a database that could be modified by end-users, more spatially resolved baseline health data and a broader array of health impact functions. The U.S. EPA has used BenMAP to estimate the avoided human health impacts and economic benefits of a number of air quality policies, including the 2002 Non-

Road Diesel rule, the 2004 Clean Air Interstate Rule, and the 2011 Mercury and Air Toxics rules, among many others. Over 50 researchers have published over 25 journal articles using BenMAP.

Beginning in 2011, the U.S. EPA began redeveloping the tool from the ground-up to meet two goals: (1) create an open-source software platform so that anyone could see the software code and improve the program; (2) improve the performance, accessibility, capabilities and usability of the software. In the Fall of 2013, after iterating through dozens of beta versions, the U.S. EPA released version 1.0 of the environmental Benefits Mapping and Analysis Program—Community Edition (BenMAP-CE). While version 1.0 met the first of these two goals, attaining the second will require additional effort on the part of U.S. EPA and its partners.

Specific activities and tasks supported by this funding are described below, along with the project timeline and budget. In accordance with the contract and as directed by the WAM, the Contractor shall provide all data (including software and programming code) obtained and developed under this work assignment. Data shall be delivered in complete form, in the media and format directed by the WAM. The Contractor shall not use proprietary software in BenMAP-CE.

## **V. STATEMENT OF WORK**

Specific activities and tasks, as well as the schedule for deliverables are outlined below.

### **Task 1: Develop a work plan and project plan**

The Contractor shall develop a new work plan and update the system design document as described below.

#### **Task 1.a: Develop work plan and administer project**

Within 20 calendar days of the effective date of this WA, the Contractor shall submit a work plan to the Work Assignment Manager (WAM). The Contractor shall arrange and conduct an initial phone conference with the WAM within one week of the WAM approving the WA. Subsequent to this initial teleconference, the Contractor shall lead regular phone conferences on at least a weekly basis to discuss work progress and any issues associated with the work tasks. The Contractor shall prepare an agenda for such weekly meetings, record meeting minutes, and distribute such meeting minutes to all participants.

#### **Task 1.b: Update the system design document**

The Contractor, consulting with the WAM, shall continue developing the comprehensive and detailed project plan for each task in this WA begun under Work Assignment 2-26, specifying clearly the technical and functional basis for the new version:

- The minimum design characteristics of the new software

- A workflow describing the expected inputs and outputs of each new program algorithm, including example use cases.
- Desired behavior of graphical the graphic user interface, including sketches of windows, location of hover text, etc.
- Protocol for quality assuring each new feature.
- Sequence in which the Contractor will address the tasks below.

The Contractor shall not modify the source code until the WAM approves this project plan. The Contractor shall develop the system design document for each new BenMAP-CE feature on a rolling basis and in consultation with the Work Assignment Manager.

**Deliverables:**

- 1.1. Work plan
- 1.2. System design document

**Task 2: Identify additional GIS-based health impact modules**

Continuing work begun under Work Assignment 3-06, the Contractor shall assess the extent to which the DotSpatial GIS software may be scaled and adapted to support future health impact modules. In particular, the Contractor shall consider the ability of the GIS to assess the human health impacts of water quality and vector-borne illnesses, as well as recreational and residential visibility. The contractor shall investigate the feasibility of addressing: (1) vector-borne diseases from ticks; (2) increased incidence of adverse health outcomes due to elevated rainfall from extreme weather events. For each stressor, the Contractor shall:

- Detail the input data needed to quantify those stressors—including environmental, population, health and stressor-response relationships. The Contractor shall consult the literature review performed to support the National Climate Assessment to identify candidate studies that may be used to create stressor-response functions.
- Describe the changes, if any, needed to the BenMAP-CE tool to calculate these impacts—including changes to the GIS, database, reports and audit trail. Where necessary, the Contractor shall amend the system design document to reflect these program changes.
- Upon the approval of the WAM, the Contractor shall modify the BenMAP-CE tool to assess one to two test cases.
- To the extent that the Contractor has developed a viable approach for quantifying these impacts in BenMAP-CE, the Contractor shall develop one or two proof-of-concept test cases, to be documented in a memorandum.

**Deliverables:**

- 2.1 GIS health impact module final report
- 2.2 Detailed GIS health impact module report
- 2.3 Modify the BenMAP-CE tool to quantify one to two environmental stressors

## 2.4 Health impact memorandum

### **Task 3: Incorporate New Multi-Pollutant and Multi-Stressor Algorithms**

The Contractor shall modify the BenMAP-CE algorithms in two key ways: (1) allow users to specify multiple effect coefficients and air quality (or stressor) changes in the program; (2) enable users to assign health impact functions to discrete geographic areas.

#### **Task 3.a: Multi-pollutant health impact functions**

The Contractor shall modify the BenMAP-CE program so that it can estimate the joint health impacts associated with changes in more than one pollutant or stressor (e.g. temperature). Specifically, BenMAP-CE will be able to:

- Incorporate more than one set of baseline and control air quality or stressor files
- Incorporate more than one effect coefficient in the health impact function editor (e.g. specify a health impact function which has two pollutants with separate effect coefficients and an interaction coefficient)
- Be able to process complex health impact functions with multiple forms, including (but not limited to) quadratic functions, conditional functions, splines and daily thresholds.
- Quantify an uncertainty distribution for a multi-pollutant health impact function using the variance/co-variance matrix specified in the epidemiological study supplying the effect coefficient.
- Report and map changes in air quality and stressors and health impacts.

The changes above will require the Contractor to modify both the user interface and program logic extensively. The Contractor shall both reference the system design document (described above) and consult regularly with the WAM when making these changes. The WAM will provide the Contractor with one or more examples of the algorithm in SAS or R. One or more EPA biostatisticians and air pollution epidemiologists will participate in the project team and serve as a technical resource to the Contractor.

#### **Task 3.b: Applying health impact functions by geographic area**

The Contractor shall modify the BenMAP-CE program so that users can apply a health impact function to a discrete geographic location—for example, a region, state or county. The Contractor shall modify BenMAP-CE so that it:

- Allows users to assign a function to a specific geographic area within either the function editor or “on the fly” using the BenMAP-CE GIS.
- Estimates health impacts only for each location to which that health impact function is assigned.

- Can import a user-provided spreadsheet of health impact functions assigned to discrete geographic areas
- Reports clearly the health impact estimates in the report window and GIS for each geographic area.

As above, these changes will require the Contractor to modify both the user interface and program logic extensively. For these reasons, the Contractor shall reference closely the system design document and consult regularly with the WAM. The Contractor shall also identify epidemiological studies performed for a subset of countries identified by the WAM, develop health impact functions for these countries, and load these data into the BenMAP-CE database. And, as above, the Contractor shall perform one or more test cases to be reviewed by the WAM.

The Contractor shall not modify the source code until the WAM approves this project plan.

### **Task 3.c: Test the new features**

Upon modifying the BenMAP-CE program as described above to estimate multi-pollutant health impact functions, and assign health impact functions to discrete geographic areas, the Contractor shall evaluate these features using two to three test cases specified by the WAM. Specifically, the Contractor shall:

- Quantify multi-stressor and multi-pollutant health impacts using WAM-specified epidemiological studies and WAM-supplied air quality surfaces
- Apply city-specific risk coefficients in a health impact analysis using WAM-specified epidemiological studies and WAM-supplied air quality surfaces
- Assist the WAM in documenting these results for a manuscript that will be submitted for peer review. This manuscript will describe the key methodological differences in using this approach as compared to traditional health impact assessments. The manuscript shall also characterize the influence of key analytical inputs and assumptions to create a matrix of factors that most influence the size and distribution of health impacts.

### **Deliverables:**

- 3.1 Draft multi-pollutant health impact function feature
- 3.2 Final multi-pollutant health impact function feature
- 3.3 Draft location-specific health impact function feature
- 3.4 Final location-specific health impact function feature
- 3.5 Document changes to user interface and new algorithms in the user manual
- 3.6 Test cases performed
- 3.7 Manuscript for peer review

## Quality Assurance

The Contractor shall identify or include references of where to find the quality assurance criteria (e.g., data completeness minimum number of observations) that will be or that was applied to the data used in this work assignment. The implemented quality assurance procedures, data sources (and data acquisition date), explanation of the appropriateness of the data for the intended use and other pertinent data qualifications shall be stipulated in all deliverables produced via this work assignment.

## VI. REPORTING REQUIREMENTS

1. The Contractor shall submit a detailed cost estimate within fourteen calendar days of the effective date of this work assignment. The estimated cost shall include direct labor, overhead, consultant and subcontractor fee, other direct costs, and estimated total fee.
2. The Contractor shall submit monthly progress reports in accordance with the contract.
3. During the period of performance of this contract, the Contractor shall inform the WAM immediately (by telephone and email) of any problem(s) that may impede performance, as well as corrective actions needed from the Contractor and the EPA to resolve the problem(s).

## VII. DELIVERABLES AND SCHEDULE

<b>Task number</b>	<b>Task Name</b>	<b>Deadline</b>	<b>Notes</b>
1.1	Work plan	Within 20 days of effective date	
1.2	System design document	Developed throughout duration of work assignment	System design document will specify sequence of BenMAP-CE improvements below. WAM will specify deliverable date for each task.
2.1	GIS health impact module final report	June 1 <sup>st</sup>	
2.2	Detailed GIS health impact module final report	July 1 <sup>st</sup>	
2.3	Modify BenMAP-CE to quantify one or two stressors	August 1 <sup>st</sup>	
2.4	Health impact memorandum	September 1 <sup>st</sup>	
3.1	Draft multi-pollutant feature	August 1 <sup>st</sup>	
3.2	Final multi-pollutant feature	November 1 <sup>st</sup>	
3.3	Draft location-specific feature	December 15 <sup>th</sup>	

<b>Task number</b>	<b>Task Name</b>	<b>Deadline</b>	<b>Notes</b>
3.4	Final location-specific feature	February 1 <sup>st</sup>	
3.5	Update the user manual	Developed throughout duration of work assignment	
3.6	Test cases	February 15 <sup>th</sup>	
3.7	Manuscript for peer review	March 15 <sup>th</sup>	

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-06

Other  Amendment Number:  
000001

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 09/30/2016  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Incorporating Multi-pollutant

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
8

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 09/30/2016

Comments:  
THIS AMENDMENT IS TO EXTEND THE CURRENT OPTION PERIOD (4), PERIOD OF PERFORMANCE, FOR 6 MONTHS (ENDING 9/30/2016). CONTRACTOR SHALL PROCEED WITH WORK ASSIGNMENT, REVISING COST ESTIMATE IF NEEDED. NO PREVIOUSLY PERFORMED WORK SHALL BE DUPLICATED.

Superfund

Accounting and Appropriations Data

Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 09/30/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee: LOE:

Cumulative Approved: Cost/Fee: LOE:

Work Assignment Manager Name Neal Fann

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-0209  
FAX Number:

Project Officer Name Carolyn Blake

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Marsha B. Johnson

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-0952  
FAX Number:

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-06

Other  Amendment Number:  
000002

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 05/31/2017  
Base  Option Period Number

Title of Work Assignment/SF Site Name  
Incorporating Multi-Pollutant

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
8

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 05/31/2017

Comments:  
THIS AMENDMENT IS TO EXTEND THE CURRENT OPTION PERIOD FOR 8 MONTHS (ENDING 5/31/2017), AND TO CHANGE CO TO CHRISTOPHER DAVIS. CONTRACTOR SHALL PROCEED WITH WORK ASSIGNMENT, REVISING COST ESTIMATE IF NEEDED. NO PREVIOUSLY PERFORMED WORK SHALL BE DUPLICATED.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
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4										
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 05/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Neal Fann  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-0209  
FAX Number:

Project Officer Name Carolyn Blake  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Christopher Davis  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-4609  
FAX Number: 919-685-3415

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-06

Other  Amendment Number:  
000003

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 05/31/2017  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Incorporating Multi-Pollutant

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
8

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 05/31/2017

Comments:  
THIS PROJECT IS COMPLETE. THEREFORE, THIS AMENDMENT IS ISSUED TO STOP WORK ON THIS PROJECT.

Superfund

Accounting and Appropriations Data

Non-Superfund

SFO  
(Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 05/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee: LOE:

Cumulative Approved: Cost/Fee: LOE:

Work Assignment Manager Name Neal Fann  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-0209  
FAX Number:

Project Officer Name Carolyn Blake  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Christopher Davis  
  
\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-4609  
FAX Number: 919-685-3415

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number

4-07

Other  Amendment Number:

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 03/31/2016

Title of Work Assignment/SF Site Name

Base Option Period Number 4

Revisions and Improvements to

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
Sections 19

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance

From 04/01/2015 To 03/31/2016

Comments:

WA 4-07 Full Title: Revisions and Improvements to the EPA Air Pollution Control Cost Manual

Continuation of WA 3-07. See attached SOW. 300 hours are provided for preparation of the work plan and to begin working on the WA.

Superfund

Accounting and Appropriations Data

Non-Superfund

Note: To report additional accounting and appropriations data use EPA Form 1900-69A.

SFO (Max 2)

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee: LOE:

Cumulative Approved: Cost/Fee: LOE:

Work Assignment Manager Name Larry Sorrels

Branch/Mail Code:

Phone Number 919-541-5041

FAX Number:

(Signature)

(Date)

Project Officer Name Jolynn Collins

Branch/Mail Code:

Phone Number: 919-541-5671

FAX Number:

(Signature)

(Date)

Other Agency Official Name

Branch/Mail Code:

Phone Number:

FAX Number:

(Signature)

(Date)

Contracting Official Name Rodney-Daryl Jones

Branch/Mail Code:

Phone Number: 919-541-3112

FAX Number:

(Signature)

(Date)

## Statement of Work

- I. TITLE:** Revisions and Improvements to the EPA Air Pollution Control Cost Manual
- II. CONTRACTOR:** Research Triangle Institute (RTI)
- III. WORK ASSIGNMENT CONTRACTING OFFICER REPRESENTATIVE (WACOR):**

Larry Sorrels  
U. S. Environmental Protection Agency  
Office of Air Quality Planning and Standards  
Health and Environmental Impacts Division  
Air Economics Group, MD: C439-02  
Research Triangle Park, NC 27711  
(919) 541-5041 (office) (919) 541-0839(fax)  
[sorrels.larry@epa.gov](mailto:sorrels.larry@epa.gov)

Alternate WACOR: David Misenheimer  
U. S. Environmental Protection Agency  
Office of Air Quality Planning and Standards  
Health and Environmental Impacts Division  
Air Economics Group, MD: C439-02  
Research Triangle Park, NC 27711  
919-541-5473 (office) (919) 541-0839 (fax)  
[misenheimer.david@epa.gov](mailto:misenheimer.david@epa.gov)

### **IV. BACKGROUND:**

The Air Economics Group (AEG) is responsible for maintaining the EPA Air Pollution Control Cost Manual (henceforth the “Cost Manual”), a document that provides guidance to EPA and others for preparing cost analyses of installation and operation of add-on or end-of-pipe pollution control equipment. This document has existed since the 1980’s and has served as a key basis for cost analyses done by EPA for many different rulemakings and has been a foundation for guidance including costs in the course of permit review by EPA and States. The Cost Manual has been well used for such purposes, and has become an important source of information for these purposes over many years. The Cost Manual has not been updated for a number of years (not since 2003), and the purpose of the current work assignment (WA) is to provide for revisions to update this document. In particular, the revisions in this work assignment will focus on preparing revisions in response to public comments on the SNCR and SCR draft chapters that have been prepared by this Contractor under previous work assignments, to prepare revised VOC control chapters for internal EPA workgroup review and to respond to public comments on the revised VOC control chapters, and to begin work on revising the SO<sub>2</sub> control chapters. The Contractor shall not duplicate work previously performed.

**V. STATEMENT OF WORK (SOW):**

The WACOR is authorized to provide technical direction in accordance with the contract. In accordance with the contract SOW, the contractor shall perform the following tasks:

**Task 1: Prepare Work Plan and Other Administrative Requirements**

The Contractor shall prepare a work plan and submit this to the WACOR. The Contractor shall have conference calls with the WACOR on, at least, a monthly basis after approval of the work plan to plan and review progress of this WA.

**Deliverables Under Task 1**

1a Work plan: Within twenty days of the effective date of this WA.

**Task 2: Revise EPA Air Pollution Control Cost Manual Chapters**

In accordance with task 19 of the contract SOW, the Contractor shall revise various chapters in the EPA Air Pollution Control Cost Manual. These revisions include changes to the contents of the existing document and/or additional appendices as needed to address internal or external issues with data or methodologies employed by the Agency. Revisions shall be completed for the existing SNCR and SCR chapters prepared by this contractor. In addition, the Contractor shall prepare revisions to the VOC control chapters, beginning with the Incinerators chapters and then progressing to all of the other three VOC chapters. It should be noted that work to complete the SNCR and SCR chapters may coincide with work on revising the VOC chapters. Finally, the Contractor shall begin work on revising the SO<sub>2</sub> chapter (wet scrubbers).

The EPA WACOR will initiate the process of revising the Cost Manual by providing technical direction for revising the draft Cost Manual and the schedule for completion of the required revisions.

**Deliverables Under Task 2**

2a Draft Revisions to Each Chapter: Within 1 month of receiving technical direction or in consultation with the EPA WACOR. Such revisions may originate with public comments or from the EPA workgroup formed to aid in development of the Control Cost Manual update. The WACOR will review and provide comments within 14 days.

2b Final Revisions: Within 3 weeks of receiving comments from WACOR.

## **VI. REPORTING REQUIREMENTS:**

All reports shall be in accordance with contract specifications. Deliverables shall be provided to the WACOR in electronic format with an accompanying master copy in hard copy format if requested by the WACOR. Deliverables shall also be provided as appropriate in the following software formats: PDF, Word format, or Excel spreadsheets. Electronic files provided to the WACOR during the course of this WA shall be free of all known computer viruses, spyware and malware prior to delivery to the WACOR.

In addition, the Contractor shall include in any final deliverable a section regarding quality assurance with data used with respect to precision, accuracy, representativeness, comparability, completeness, sensitivity, and appropriateness.

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-07

Other  Amendment Number:  
000001

Contract Number EP-W-11-029 Contract Period 04/01/2011 To 03/31/2016 Title of Work Assignment/SF Site Name  
Base Option Period Number 4 Revisions & Improvements to

Contractor RESEARCH TRIANGLE INSTITUTE Specify Section and paragraph of Contract SOW  
19

Purpose:  Work Assignment  Work Assignment Close-Out  Work Assignment Amendment  Incremental Funding  Work Plan Approval  
Period of Performance From 04/01/2015 To 03/31/2016

Comments:  
This work assignment amended to lift budgetary cap. No previously performed work shall be duplicated.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 03/31/2016 Cost/Fee: LOE:

This Action:  
Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee: LOE:

Cumulative Approved: Cost/Fee: LOE:

Work Assignment Manager Name Larry Sorrels  _____ (Signature) _____ (Date)	Branch/Mail Code: Phone Number 919-541-5041 FAX Number:
Project Officer Name Carolyn Blake  _____ (Signature) _____ (Date)	Branch/Mail Code: Phone Number: 919-541-5256 FAX Number:
Other Agency Official Name  _____ (Signature) _____ (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Rodney-Daryl Jones  _____ (Signature) _____ (Date)	Branch/Mail Code: Phone Number: 919-541-3112 FAX Number:

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-07

Other  Amendment Number:  
000002

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 09/30/2016  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Revisions & Improvements...

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
19

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 09/30/2016

Comments:  
THIS AMENDMENT IS TO EXTEND THE CURRENT OPTION PERIOD (4), PERIOD OF PERFORMANCE, FOR 6 MONTHS (ENDING 9/30/2016). CONTRACTOR SHALL PROCEED WITH WORK ASSIGNMENT, REVISING COST ESTIMATE IF NEEDED. NO PREVIOUSLY PERFORMED WORK SHALL BE DUPLICATED.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 09/30/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Larry Sorrels

Branch/Mail Code:  
Phone Number: 919-541-5041  
FAX Number:

(Signature) (Date)

Project Officer Name Carolyn Blake

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

(Signature) (Date)

Other Agency Official Name

Branch/Mail Code:  
Phone Number:  
FAX Number:

(Signature) (Date)

Contracting Official Name Marsha B. Johnson

Branch/Mail Code:  
Phone Number: 919-541-0952  
FAX Number:

(Signature) (Date)

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-07

Other  Amendment Number:  
000003

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 09/30/2016  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Revisions & Improvements...

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
Task 19

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 09/30/2016

Comments:  
SOW AMENDED TO ADD SUB-TASK TO TASK 2 OF WA (see attachment). CONTRACTOR SHALL PREPARE A REVISED WORK PLAN/COST ESTIMATE IN RESPONSE TO THIS CHANGE. NO PREVIOUSLY PERFORMED WORK SHALL BE DUPLICATED.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 09/30/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee: LOE:

Cumulative Approved: Cost/Fee: LOE:

Work Assignment Manager Name Larry Sorrels

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5041  
FAX Number:

Project Officer Name Carolyn Blake

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Marsha B. Johnson

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-0952  
FAX Number:

WAM: Larry Sorrels, OAQPS/HEID/AEG

WAM Phone Number: 919-541-5041

WAM E-mail address: [sorrels.larry@epa.gov](mailto:sorrels.larry@epa.gov)

Date: 4/7/16

Work Assignment 4-07, Modification 4

Work Assignment Title: Revisions and Improvements to the EPA Air Pollution Control Cost Manual

Statement of Work:

This modification to the work assignment is to add a sub-task to Task 2 of the work assignment. These sub-tasks are as follows:

Sub-Task 8: Spreadsheets for revised VOC control measure chapters and for the wet scrubbers chapter

Under this sub-task, the Contractor shall prepare draft and final versions of spreadsheets for the Incinerators/Oxidizers, Condensers, Carbon Adsorbers, Flares, and Wet Scrubbers chapters. These spreadsheets shall include all relevant cost and performance information from these chapters to allow for estimating capital, annual cost, and emission reductions for applying these control technologies at a unit-level. The format of these spreadsheets shall use the format of the spreadsheets prepared for the revised SNCR and SCR Cost Manual chapters under this work assignment as a basis.

Schedule for Deliverables: Each draft spreadsheet shall be prepared within 3 weeks of preparation of the final draft chapter, which is the draft that includes responses to comments from the WAM (or "EPA", in the shorthand of the work assignment). Final spreadsheets shall be prepared within 1 month of receipt of comments from the WAM but no later than September 30, 2016.

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-07

Other  Amendment Number:  
000004

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 05/31/2017  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Revisions & Improvements

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
8

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 05/31/2017

Comments:  
THIS AMENDMENT IS TO EXTEND THE CURRENT OPTION PERIOD FOR 8 MONTHS (ENDING 5/31/2017), AND TO CHANGE CO TO ANDREW FLYNN. CONTRACTOR SHALL PROCEED WITH WORK ASSIGNMENT, REVISING COST ESTIMATE IF NEEDED. NO PREVIOUSLY PERFORMED WORK SHALL BE DUPLICATED.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 05/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Larry Sorrels

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5041  
FAX Number:

Project Officer Name Carolyn Blake

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Andrew Flynn

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-2674  
FAX Number: 919-541-0611

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-07

Other  Amendment Number:  
000004

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 05/31/2017  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Revisions & Improvements

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
8

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 05/31/2017

Comments:  
THIS AMENDMENT IS TO EXTEND THE CURRENT OPTION PERIOD FOR 8 MONTHS (ENDING 5/31/2017), AND TO CHANGE CO TO ANDREW FLYNN. CONTRACTOR SHALL PROCEED WITH WORK ASSIGNMENT, REVISING COST ESTIMATE IF NEEDED. NO PREVIOUSLY PERFORMED WORK SHALL BE DUPLICATED.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 05/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee: LOE:

Cumulative Approved: Cost/Fee: LOE:

Work Assignment Manager Name Larry Sorrels

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5041  
FAX Number:

Project Officer Name Carolyn Blake

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Andrew Flynn

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-2674  
FAX Number: 919-541-0611

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-07

Other  Amendment Number:  
000005

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 11/30/2017  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Revisions & Improvements

Contractor  
RESEARCH TRIANGLE INSTITUTE

Specify Section and paragraph of Contract SOW  
8

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 11/30/2017

Comments:  
THIS AMENDMENT IS TO EXTEND THE CURRENT OPTION PERIOD (4) FOR 6 MONTHS (ENDING 11/30/2017). CONTRACTOR SHALL PROCEED WITH WORK ASSIGNMENT, REVISING COST ESTIMATE IF NEEDED. NO PREVIOUSLY PERFORMED WORK SHALL BE DUPLICATED.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
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3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 11/30/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Larry Sorrels

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5041  
FAX Number:

Project Officer Name Carolyn Blake

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

Other Agency Official Name

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number:  
FAX Number:

Contracting Official Name Christopher Davis

\_\_\_\_\_  
(Signature) (Date)

Branch/Mail Code:  
Phone Number: 919-541-4609  
FAX Number: 919-685-3415

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-07

Other  Amendment Number:  
000006

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 11/30/2017  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Revisions & Improvements...

Contractor  
Research Triangle Institute

Specify Section and paragraph of Contract SOW  
8

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 11/30/2017

Comments:  
The purpose of this Amendment to the Work Assignment is to replace the Alternate WAM as follows: FROM:  
David Meisenheimer TO: Toni Jones. Ms. Jones contact information is email: jones.toni@epa.gov, Phone No.:  
919-541-0316. All other terms and conditions remain unchanged.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
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3										
4										
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 11/30/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Larry Sorrels

Branch/Mail Code:  
Phone Number: 919-541-5041  
FAX Number:

(Signature) (Date)

Project Officer Name Carolyn Blake

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

(Signature) (Date)

Other Agency Official Name

Branch/Mail Code:  
Phone Number:  
FAX Number:

(Signature) (Date)

Contracting Official Name Christopher Davis

Branch/Mail Code:  
Phone Number: 919-541-4609  
FAX Number: 919-685-3415

(Signature) (Date)

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-07

Other  Amendment Number:  
000007

Contract Number  
EP-W-11-029

Contract Period 04/01/2011 To 05/31/2018  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Revisions & Improvements...

Contractor  
Research Triangle Institute

Specify Section and paragraph of Contract SOW  
8

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 05/31/2018

Comments:  
This amendment formalizes the direction given by the CO on 11/29/17, via e-mail, to extend the current option period (4), period of performance, for 6 months (ending 05/31/2018). Contractor shall proceed with work assignment, revising cost estimate if needed. No previously performed work shall be duplicated.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2011 To 05/31/2018 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Larry Sorrels

Branch/Mail Code:  
Phone Number: 919-541-5041  
FAX Number:

(Signature) (Date)

Project Officer Name Carolyn Blake

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

(Signature) (Date)

Other Agency Official Name

Branch/Mail Code:  
Phone Number:  
FAX Number:

(Signature) (Date)

Contracting Official Name Christian Ford-Cannon

Branch/Mail Code:  
Phone Number: 919-541-2147  
FAX Number:

(Signature) (Date)

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-07

Other  Amendment Number:  
000008

Contract Number  
EP-W-11-029

Contract Period 06/01/2017 To 11/30/2018  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Revisions & Improvements...

Contractor  
Research Triangle Institute

Specify Section and paragraph of Contract SOW  
8

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 11/30/2018

Comments:  
This amendment lifts the budgetary cap to the approved work plan estimate of \$431,079. Additionally, it extends the current option period (4) for 6 months (ending 11/30/2018). Contractor shall proceed with work assignment, revising cost estimate if needed. No previously performed work shall be duplicated.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 06/01/2017 To 11/30/2018 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Larry Sorrels

Branch/Mail Code:  
Phone Number: 919-541-5041  
FAX Number:

(Signature) (Date)

Project Officer Name Carolyn Blake

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

(Signature) (Date)

Other Agency Official Name

Branch/Mail Code:  
Phone Number:  
FAX Number:

(Signature) (Date)

Contracting Official Name Christian Ford-Cannon

Branch/Mail Code:  
Phone Number: 919-541-2147  
FAX Number:

(Signature) (Date)

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-07

Other  Amendment Number:  
000009

Contract Number  
EP-W-11-029

Contract Period 06/01/2017 To 11/30/2018  
Base Option Period Number 4

Title of Work Assignment/SF Site Name  
Revisions & Improvements . . .

Contractor  
Research Triangle Institute

Specify Section and paragraph of Contract SOW  
8

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 11/30/2018

Comments:  
SOW amended (see attachment) to add/update tasks to the SOW. Contractor shall prepare a revised work plan/cost estimate in response to these changes. No previously performed work shall be duplicated.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 06/01/2017 To 11/30/2018 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Larry Sorrels

Branch/Mail Code:  
Phone Number: 919-541-5041  
FAX Number:

\_\_\_\_\_  
(Signature) (Date)

Project Officer Name Carolyn Blake

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

\_\_\_\_\_  
(Signature) (Date)

Other Agency Official Name

Branch/Mail Code:  
Phone Number:  
FAX Number:

\_\_\_\_\_  
(Signature) (Date)

Contracting Official Name Christian Ford-Cannon

Branch/Mail Code:  
Phone Number: 919-541-2147  
FAX Number:

\_\_\_\_\_  
(Signature) (Date)

WAM: Larry Sorrels, OAQPS/HEID/AEG

WAM Phone Number: 919-541-5041

WAM E-mail address: [sorrels.larry@epa.gov](mailto:sorrels.larry@epa.gov)

Date: 8/7/18

Work Assignment 4-07, Modification 5

Work Assignment Title: Revisions and Improvements to the EPA Air Pollution Control Cost Manual

Statement of Work:

This modification to the work assignment is to revise Sub-Task 7, and to add sub-tasks 9 and 10 to Task 2 of the work assignment. The modification is as follows:

Sub-Task 7: Draft Wet Scrubbers (SO<sub>2</sub>) chapter

The language on Sub-Task 7 in this work assignment, including deliverable dates, shall be replaced by the following:

The Contractor shall revise the current draft of the wet scrubbers chapter to account for all edits provided by the WAM, and shall also incorporate updated cost and performance data for scrubbers applied to utility boilers based on information supplied by the WAM. This information reflects updated information on scrubber cost and performance that is found in the latest version (v6) of the Integrated Planning Model (IPM), a version released to the public by EPA on May 31, 2018.

The Contractor shall prepare a revised draft of the chapter that will be suitable for EPA workgroup review. This chapter draft shall then be revised based on comments from the WAM. The chapter shall be titled "Wet and Dry Scrubbers" henceforth. The revised draft shall be submitted to the WAM to meet the deliverable schedule listed below.

Schedule for Sub-Task 7 Deliverables:

Task 7a: Revised draft chapter - 1 ½ months after receipt of WA modification

Task 7b: 2<sup>nd</sup> revised draft chapter – November 30, 2018

Sub-Task 9: Revisions to SNCR and SCR chapters, and to the SNCR and SCR cost spreadsheets

Under this sub-task, the Contractor shall revise the SNCR and SCR chapters to include updates to the cost and performance data based on information supplied by the WAM. This information reflects updated information on SNCR and SCR cost and performance that is found in the latest version (v6) of the Integrated Planning Model (IPM), a version released to the public by EPA on May 31, 2018. The Contractor shall also update the SNCR and SCR cost spreadsheets to include the updated data.

The Contractor shall prepare a revised draft of each chapter including these updates and other edits from the WAM. The Contractor shall also prepare revised cost spreadsheets that include these updates. These deliverables shall be submitted to the WAM to meet the schedule listed below.

Schedule for Sub-Task 9 Deliverables:

Task 9a: Revised SNCR and SCR chapters - 3 weeks after receipt of WA modification

Task 9b: Revised cost spreadsheets - 1 week after completion of Task 9a

Sub-Task 10: NOx Combustion Controls chapter – Low NOx/Ultra-low NOx Burners

Under this sub-task, the Contractor shall prepare a new control measure chapter for the Control Cost Manual: 1) for low NOx and ultra low NOx. This new chapter shall be prepared using an outline and format that will be provided by the WAM.

The Contractor shall begin by conducting a literature search and an Internet search for information on recent changes in the design, operation, performance and cost of the relevant control equipment. Potential sources of information include trade journal articles, conference proceedings, EPA technical studies, EPA background documentation for rulemaking packages, background documents for RACT, BACT or BART analyses, and control equipment vendor websites. European studies will also be considered as sources of cost data.

The Contractor shall prepare a draft of the chapter consistent with the chapter outline and any additional information from the literature search and guidance from the WAM. This shall include updates to the description of the technology, the capital cost data, and the example calculation for a model facility. Appendices may be provided to present material that is more supplemental to the presented methodology or to address other internal or external issues with the presented data or methodologies. The Contractor shall revise the draft based on comments from the WAM and submit a revised version of the draft chapter back to the WAM. The WAM will distribute this revised version of the chapter to the work group for review.

Schedule for Sub-Task 10 Deliverables:

Task 10a: Draft low NOx and ultra low NOx burners chapter - 2 months after receipt of WA modification

Task 10b: Revised low NOx and ultra low NOx burners chapter – November 30, 2018

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-07

Other  Amendment Number:  
000010

Contract Number  
EP-W-11-029

Contract Period 06/01/2017 To 05/31/2019  
Base  Option Period Number

Title of Work Assignment/SF Site Name

Contractor  
Research Triangle Institute

Specify Section and paragraph of Contract SOW

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 05/31/2019

Comments:  
The purpose of this amendment is to extend the period of performance as stated in P00094 of the contract.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 06/01/2017 To 05/31/2019 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Larry Sorrels

Branch/Mail Code:  
Phone Number: 919-541-5041  
FAX Number:

(Signature) (Date)

Project Officer Name Carolyn Blake

Branch/Mail Code:  
Phone Number: 919-541-5256  
FAX Number:

(Signature) (Date)

Other Agency Official Name

Branch/Mail Code:  
Phone Number:  
FAX Number:

(Signature) (Date)

Contracting Official Name Christian Ford-Cannon

Branch/Mail Code:  
Phone Number: 919-541-2147  
FAX Number:

(Signature) (Date)

EPA

United States Environmental Protection Agency  
Washington, DC 20460

Work Assignment

Work Assignment Number  
4-07

Other  Amendment Number:  
000011

Contract Number  
EP-W-11-029

Contract Period 06/01/2017 To 09/30/2019  
Base  Option Period Number

Title of Work Assignment/SF Site Name

Contractor  
Research Triangle Institute

Specify Section and paragraph of Contract SOW

Purpose:  Work Assignment  Work Assignment Close-Out  
 Work Assignment Amendment  Incremental Funding  
 Work Plan Approval

Period of Performance  
From 04/01/2015 To 09/30/2019

Comments:  
The purpose of this modification is to extend the period of performance in accordance with P00097. The WA was extended via the modification.

Superfund Accounting and Appropriations Data  Non-Superfund

SFO (Max 2)

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 06/01/2017 To 09/30/2019 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Larry Sorrels

Branch/Mail Code:  
Phone Number: 919-541-5041  
FAX Number:

(Signature) (Date)

Project Officer Name Carolyn Blake

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Branch/Mail Code:  
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Contracting Official Name Christian Ford-Cannon

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